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A Study of the lake sturgeon (*Acipenser fluvescens)* in the Sipiwesk Lake area of the Nelson River, Manitoba, 1976-1978.

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ABSTRACT

The age, growth, mortality and population size of lake sturgeon, Acipenser fluvescens, in the Sipiwesk Lake area of the Nelson River were examined during 1976 - 1978. The above vital statistics were based on adult or spawning-run sturgeons captured at the mouth of the Landing River during May and June. A total of 316 sturgeons were captured in the three years. The fish captured in 1977 and 1978 ranged in age from 14 to 70 years. The mean age of sturgeons caught in 1977 was 23.4 $\pm$ 2.0 years, while in 1978 it was 27.0 $\pm$ 1.1 years. The total annual survival rate of the Nelson River sturgeon based on recoveries of tagged fish recaptured in 1978 was 0.89. The population size of adult sturgeons around the Landing River, based on tag recoveries by commercial fishermen, was 3236 fish. Most of the tagged fish recoveries were made in the immediate vicinity of the tagging site.

Comparison of the combined 1977-1978 age frequency distributions of Nelson River sturgeons to those reported for the years 1953 - 1956 and 1959 revealed a close similarity to the age frequency distribution observed in 1959. Modal ages in these cases were centered around 25 years. The commercial fishery for lake sturgeon in the Nelson River was closed for an 11-year period following 1959.

TABLE OF CONTENTS

	Page
ABSTRACT	*i*
INTRODUCTION	1
METHODS AND MATERIALS	6
Fish Sampling	6
Age Determinations	11
Environmental Measurements	12
RESULTS	13
Age and Growth	13
Population Estimate and Exploitation Rate	15
Mortality and Survival	24
Sturgeon Migration	28
Sex and Maturity	28
The Spawning Migration	30
DISCUSSION	33
Comparisons with Other Studies	33
Age Frequency Distributions	34
The Effect of Exploitation	37
ACKNOWLEDGEMENTS	40
LITERATURE CITED	41
APPENDICES	43

LIST OF TABLES

Table		Page
1	Sturgeon production of the Nelson River commercial fishery. The 1907-1959 period is taken from Sunde, 1960 (memorandum to S. Sigurdson). Production is given in pounds marketed weight	3
2	Sampling schedule for the Nelson River sturgeon study in 1976-1978	8
3	Age-specific mean lengths (cm) for Nelson River sturgeons tagged in 1977 and 1978. The figures in parentheses are the number sampled in each age group	14
4	Mortality, exploitation and survival rates for the Nelson River sturgeon population in 1978	27
5	Water temperatures and sturgeon catches in the Landing/Nelson rivers tagging project	31
6	Sturgeon catches and water levels in the Landing River, 1978	32
7	A comparison of weight-length relationships of sturgeons reported in other studies to those determined in the present study	35

LIST OF FIGURES

Figure		Page
1	The upper Nelson River showing the location of the 1976-1978 tagging site. Also shown are the management units for the Nelson River commercial sturgeon fishery. Inset shows the two management units on the lower Nelson River	4
2	The mouth of the Landing River showing the location of the net sets, and temperature and water metering stations	7
3	Photograph of sturgeon sampling equipment	9
4	Length frequency distribution of sturgeons taken in 1977	16
5	Length frequency distribution of sturgeons taken in 1978	17
6	Weight frequency distribution of sturgeons taken in 1977	18
7	Weight frequency distribution of sturgeons taken in 1978	19
8	Age frequency distribution of sturgeons taken in 1977	20
9	Age frequency distribution of sturgeons taken in 1978	21
10	Age frequency distribution of sturgeons for 1977 and 1978 combined	25
11	Map showing locations of sturgeon recaptures	29
12	Comparison of age frequency distributions of Nelson River sturgeons observed by Sunde (1961) and that observed in the present investigation	36

INTRODUCTION

Northern Manitoba supports one of the few remaining commercial sturgeon fisheries in North America. The sturgeon was formerly very widespread in North America, but many populations have been extirpated due to overexploitation and habitat degradation. In Manitoba a few local sturgeon populations remain and these support significant commercial fisheries. Sturgeon command the highest price of all freshwater commercial fish in Manitoba. However, due to a combination of increasing exploitation and environmental degradation (dams, pollution), these populations may be in jeopardy. It is therefore imperative that they be studied in order to refine management.

The Nelson River sturgeon populations have had a long history of exploitation. The earliest catch records date from 1907 (Table 1). This fishery exhibited the classic "fishing up" process, but after the peak (1924) catch steadily declined until 1959 when commercial fishing was halted for eleven years (Table 1). Fishing resumed in 1971 and catches have averaged 6,100 pounds yearly (Table 1). These data are all taken from the catch records for management units 1 and 2 (see Figure 1).

Presently the following management regulations apply to the Nelson River sturgeon fishery in the vicinity of Sipiwesk Lake:

1. Annual quota - 17,000 pounds total. This quota is divided among 5 management units as follows (Figure 1):

Unit 1 - 5,000 pounds
Unit 2 - 4,000 pounds
Unit 3 - 3,000 pounds
Unit 4 - 3,000 pounds
Unit 5 - 2,000 pounds

2. Gear - 13 inch (stretch measure) gill nets.
3. Season - June 15 to October 31.
4. Minimum marketable length is 25 inches headless dressed.

Due to the relative rarity of lake sturgeon and their early depletion in many areas, there have been few published studies dealing with the species. Cuerrier (1951) determined that pectoral fin rays were the best structure for ageing sturgeon. Cuerrier and Roussow (1951) studied the age and growth of lake sturgeon from Lake St. Francis, St. Lawrence River and reported on a decline in the populations. Probst and Cooper (1954) present data from the sturgeon sport (spear) fishery in the Lake Winnebago region of Wisconsin. Rousso (1957) concluded from a study of sturgeon fin rays from Europe and Quebec that the species exhibits growth stanzas and also that the interval between spawnings of an individual fish can vary from 4 to 7 years. Sunde (1961) used commercial catch records and sampling data from 1953 - 1956 and 1959 to study age, growth and reproduction of sturgeon in the Nelson River. His data were used to formulate the sturgeon management guidelines that are presently in effect in

Table 1. Sturgeon production of the Nelson River commercial fishery. The 1907-1959 period is taken from Sunde, 1960 (memorandum to S. Sigurdson). Production is in marketed weight.

Year	Production	Year	Production
1907	7,000	1942	15,400
1908	8,000	1943	10,600
1909	25,700	1944	9,200
1910	9,000	1945	13,400
-	-	1946	5,800
1917	150,000	-	-
1918	68,000	1953	27,000
-	-	1954	30,900
1921	36,600	1955	24,400
1922	62,300	1956	27,600
1923	124,300	1957	26,100
1924	146,800	1958	16,600
1925	97,800	1959	9,500
1926	76,900		CLOSED
1927	48,200	1971	7,379
1928	500	1972	8,358
1929	4,400	1973	6,777
-	-	1974	3,614
1937	15,000	1975	3,899
1938	30,000	1976	4,245
1939	26,000	1977	7,529
1940	26,400	1978	7,494

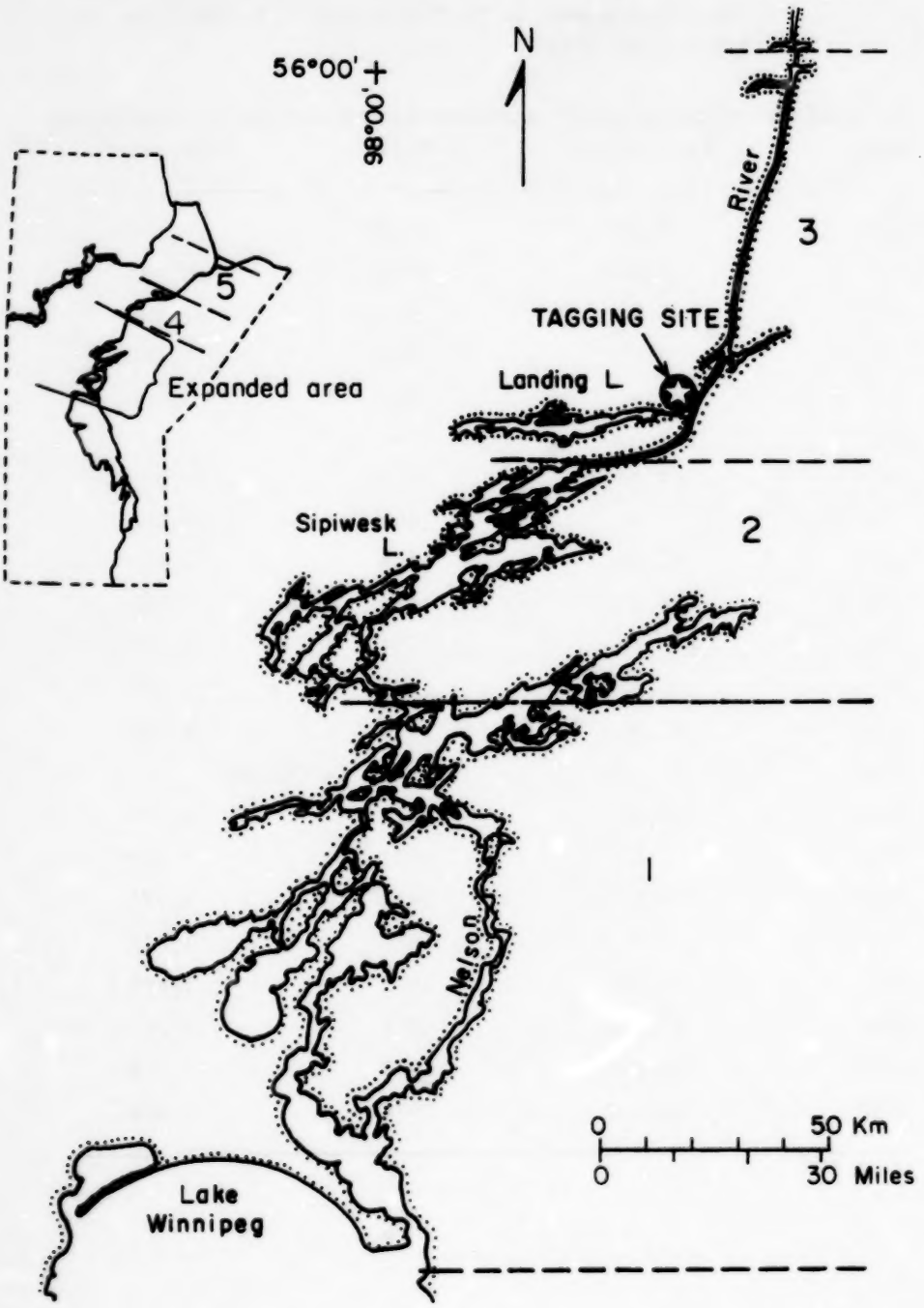

Fig. 1. The upper Nelson River showing the location of the 1976-1978 tagging site. Also shown are the management units for the Nelson River commercial sturgeon fishery. Inset shows the two management units on the lower Nelson River.

Manitoba. Scott and Crossman (1973) describe the general biology and life history of the lake sturgeon in Canada and describe the exploitation history.

The present study had the following objectives:

1. to assess the changes that have occurred in the upper Nelson River sturgeon popoulation using Sunde's (1961) study as a baseline,
2. to determine the exploitation rate from tag recoveries, and
3. to study migration.

METHODS AND MATERIALS

The general area considered in the present study encompassed the first and second sturgeon management units as defined under the Manitoba Fishery Regulations (Figure 1). This area accounts for most of the commercial sturgeon harvest from the Nelson River. The particular study area was restricted to the confluence of the Landing and Nelson rivers (Figure 2). The mouth of the Landing River is a traditional sturgeon spawning area and local people have reported large concentrations of sturgeons there in the spring.

Fish Sampling

During the spring seasons of 1976-1978, gillnets were set at the mouth of the Landing River (Figure 2, Table 2). The gillnets ranged in size from 10 to 13 inch mesh (stretched measure) in 1976 and 1977 and 10 to 12 inch (stretched measure) in 1978. The hoop nets which were used, caught few fish and were not used after 1977. Few data were collected in 1976 due to difficulties in finding the fish. Nets were lifted at least daily and twice a day during the peak of migration. The sturgeon were brought to shore and "tethered" prior to sampling. The tethering process involved looping heavy fishing cord (sideline) through the mouth and gills and tying the fish to shore near the sampling site. The fish were carried (one by one) to a "hammock"

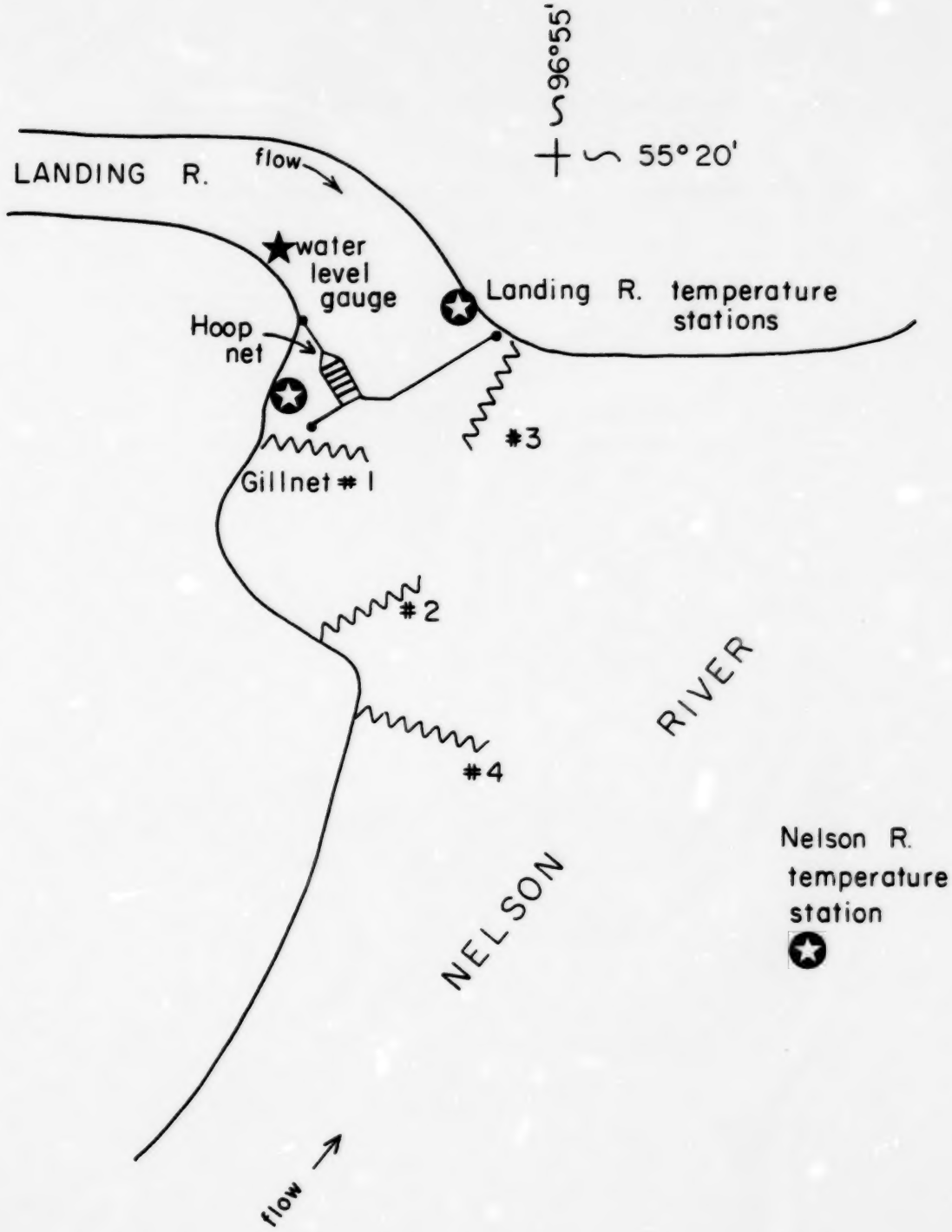

Fig. 2. The mouth of the Landing River showing the locations of the net sets and temperature and water metering stations.

Table 2. Sampling schedule for the Nelson River sturgeon study in 1976-1978.

Year	Dates
1976	June 2 - June 16
1977	May 12 - May 25
1978	May 26 - June 1

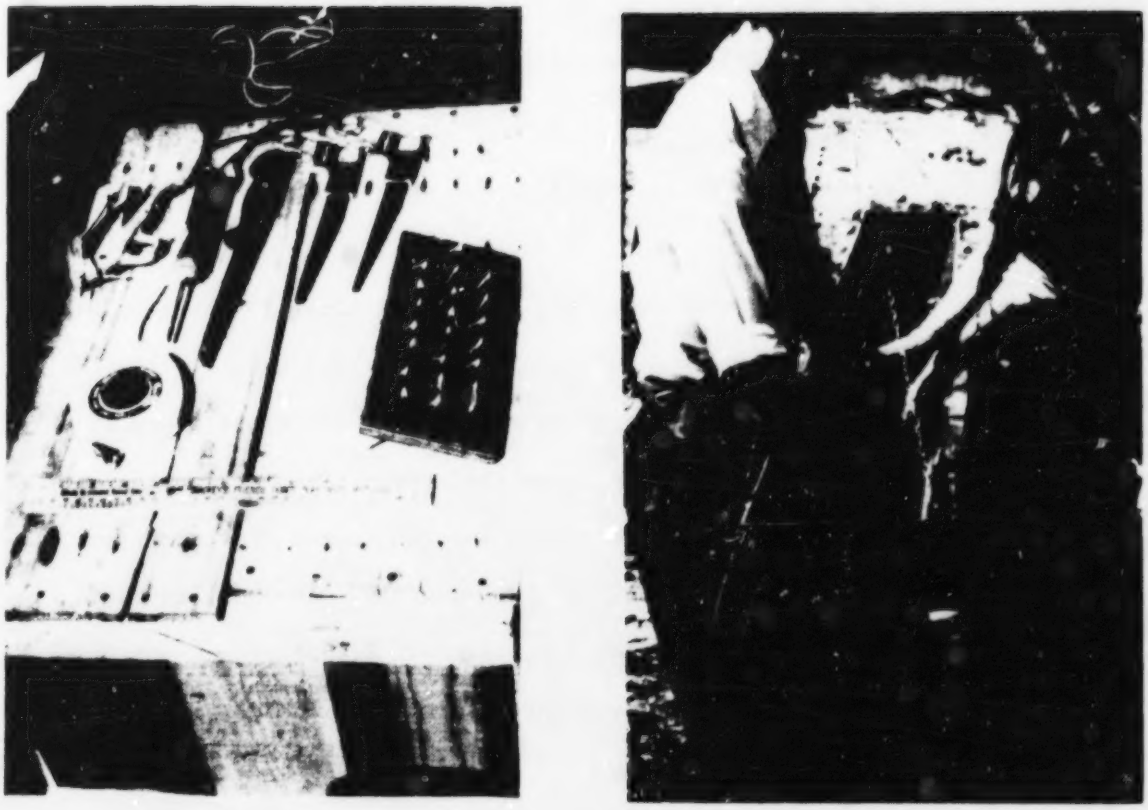

Fig. 3. Photographs of sturgeon sampling equipment.

where they could be sampled (Figure 3). Data taken from each fish included:

- total length (to nearest 0.1 cm)
- dressed length* (to nearest 0.1 cm)
- fork length (to nearest 0.1 cm)
- girth at the third scute behind the head (to nearest 0.1 cm)
- round weight (kg)
- pectoral spine for ageing.

The left pectoral spine was removed as close to the body as possible, as recommended by Sunde (1961), with a hack saw.

All sturgeon were tagged twice with two different types of numbered tags. One type was the "tuna tag" (type FT-1 large nylon dart tag - Floy Tag Mfg. Co.) and the second was the common Floy dart tag. The "tuna tags" were applied with a steel cannula. The smaller dart tags were applied with a Dennison tagging gun. Each type was applied on a different side near the posterior insertion of the dorsal fin.

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*Dressed length is measured from the insertion of the posterior ray of the dorsal fin forward to but not including the posterior edge of the cleithrum as listed in the Manitoba Fisheries Regulations.

Tags were recovered from the catches of the commercial fishermen.

After tagging, all fish were placed in a holding pan prior to release. No mortalities were noted. Several authors have remarked on the hardiness of sturgeon and our experience confirmed this. During the years of the study not a single sturgeon was ever found dead in the nets and even after handling, fin excision and tagging, no mortality was ever recorded. One sturgeon was recaptured in 1978 that had been tagged in 1976. The stump where the pectoral-spine had been removed had completely healed. There was no evidence of any infection.

Age Determinations

In the present study, pectoral spines were the only structure that could possibly have been used for aging since all fish were to be released alive. According to Cuerrier (1951) pectoral spines are the most accurate method for ageing sturgeon.

Each pectoral spine was labelled and dried in the field and then sent to the laboratory for analysis. There they were dried for a further 3 weeks. The spines were sectioned 1.3 to 1.9 mm from the base with an Isomet 11 - 1180 low speed saw using a 0.3 m thick diamond edge wafering saw blade. Note that, unlike spines from other fish, sturgeon spines are not embedded in epoxy before cutting. At least 2 sections between 0.5 to 0.8 mm were taken. Sections were placed in 85% ethanol to clean them prior to mounting on a microscope slide. Diatex, a

liquid glass solution, was placed over the section creating a permanent slide. After drying for at least 12 hours the sections were read on a Data View LF 1015 microfiche reader at 72X. Cuerrier (1951) and Sunde (1961) provide further information on ageing sturgeon.

Environmental Measurements

In both years daily water temperatures were taken in two locations, in the Landing River itself and the Nelson River (Figure 2). In 1978 a meter stick was placed in the Landing River (Figure 2), to serve as a water level gauge. Water level was assumed to be an index of water flow.

RESULTS

Age and Growth

Totals of 30, 142 and 144 sturgeons were sampled in 1976, 1977 and 1978, respectively. Because of the low numbers of fish taken in 1976, those data were not analyzed.

The weight-length regression was estimated using the following relationship from Ricker (1975):

$$\log W = \log a + b \log L$$

where:

W = weight (kg)
L = fork length (cm)
a = y intercept
b = slope of weight-length regression

The relationship for sturgeon in 1977 was $\log W = -11.85 + 3.03 \log L$ ($r = 0.95$) and for 1978 was $\log W = -12.93 + 3.26 \log L$ ($r = 0.96$) (sexes combined). There was little difference between years. Ricker (1975) states that a regression value, $b = 3$, describes isometric growth which is characterized by an unchanging body form over the course of a fish's life. The data indicate that Nelson River sturgeon grow isometrically.

There was little difference in the age-specific mean lengths between consecutive years (Table 3). Growth appeared to decline in the older ages, but with small samples of old fish it is difficult to reach

Table 3. Age-specific mean lengths (cm) for Nelson River sturgeons tagged in 1977 and 1978. The figures in parenthesis are the number sampled in each age group.

Age	1977 Length	1978 Length
14	-	97.0 (1)
15	-	-
16	86.4 (1)	90.0 (3)
17	94.0 (1)	105.0 (3)
18	91.4 (1)	99.3 (2)
19	99.9 (3)	102.5 (2)
20	102.9 (7)	104.3 (2)
21	102.9 (4)	96.8 (6)
22	107.7 (6)	101.6 (5)
23	105.1 (10)	102.1 (10)
24	104.4 (9)	102.8 (13)
25	110.5 (13)	107.0 (11)
26	104.1 (9)	107.8 (14)
27	113.0 (9)	107.9 (15)
28	114.1 (6)	108.0 (9)
29	115.9 (14)	112.7 (9)
30	121.0 (8)	116.1 (8)
31	119.8 (6)	111.5 (5)
32	118.1 (5)	115.0 (4)
33	131.7 (8)	103.5 (1)
34	114.8 (3)	119.3 (2)
35	121.9 (3)	122.0 (4)
36	124.5 (1)	124.3 (3)
37	127.9 (3)	132.2 (3)
38	137.2 (1)	131.0 (2)
39	-	123.0 (3)
40	128.2 (2)	139.0 (1)
41	125.8 (2)	-
42	137.0 (1)	-
43	-	-
44	-	138.3 (2)
45	-	-
46	134.6 (1)	-
47	137.0 (1)	-
-	-	-
55	141.7 (1)	145.0 (1)
-	-	-
70	148.6 (1)	-

definite conclusions. However, the yearly growth increments are very low (Table 3).

The 105.0 cm. to 110.0 cm length interval was the modal length class in both the 1977 (Figure 4) and 1978 (Figure 5) samples. Overall mean lengths were 112.9 cm $\pm$ 2.52* in 1977, versus 108.9 cm $\pm$ 2.31* in 1978 and were not different at the 95% level of confidence.

The 9.1 to 9.9 kg weight class was the modal class in both the 1977 (Figure 6) and 1978 (Figure 7) samples with mean weights of 12.6 kg $\pm$ 0.08 for 1977 and 10.5 kg $\pm$ 1.7 for 1978. This difference in weights was statistically significant ($P \leq 0.05$).

The sturgeons sampled in 1977 and 1978 spanned a wide range of ages from 16 to 70 years in 1977 (Figure 8) and 14 to 55 years in 1978 (Figure 9). The mean ages were 23.4 years $\pm$ 2.0 in 1977 and 27.0 years $\pm$ 1.1 in 1978. This difference in age was significant at the 95% level.

Population Estimate and Exploitation Rate

Because there were so few recaptures of fish tagged in 1977, a population estimate was calculated for 1978 only. This estimate

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* 95% confidence interval.

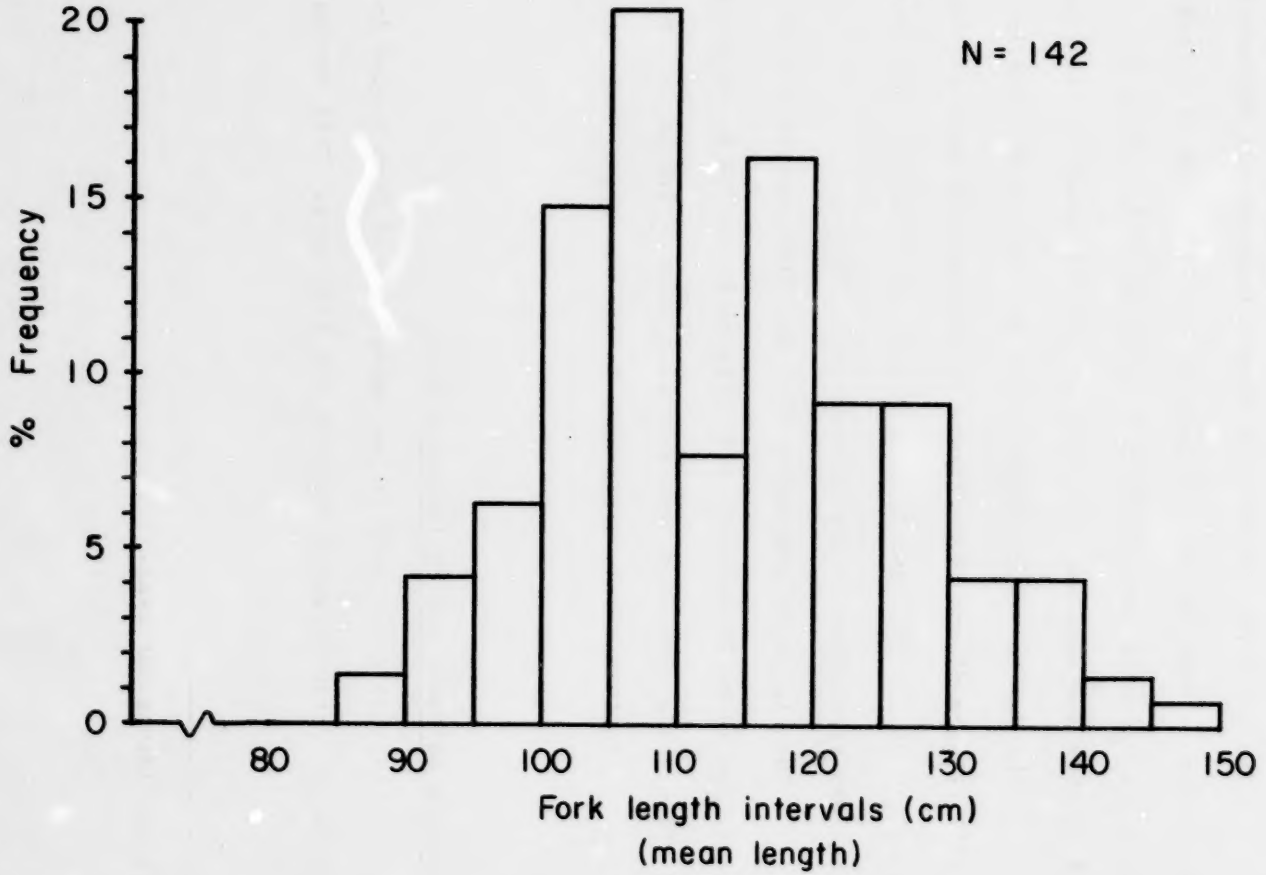

Fig. 4. Length frequency distribution of sturgeons taken in 1977. Mesh sizes used were 10-13 inch.

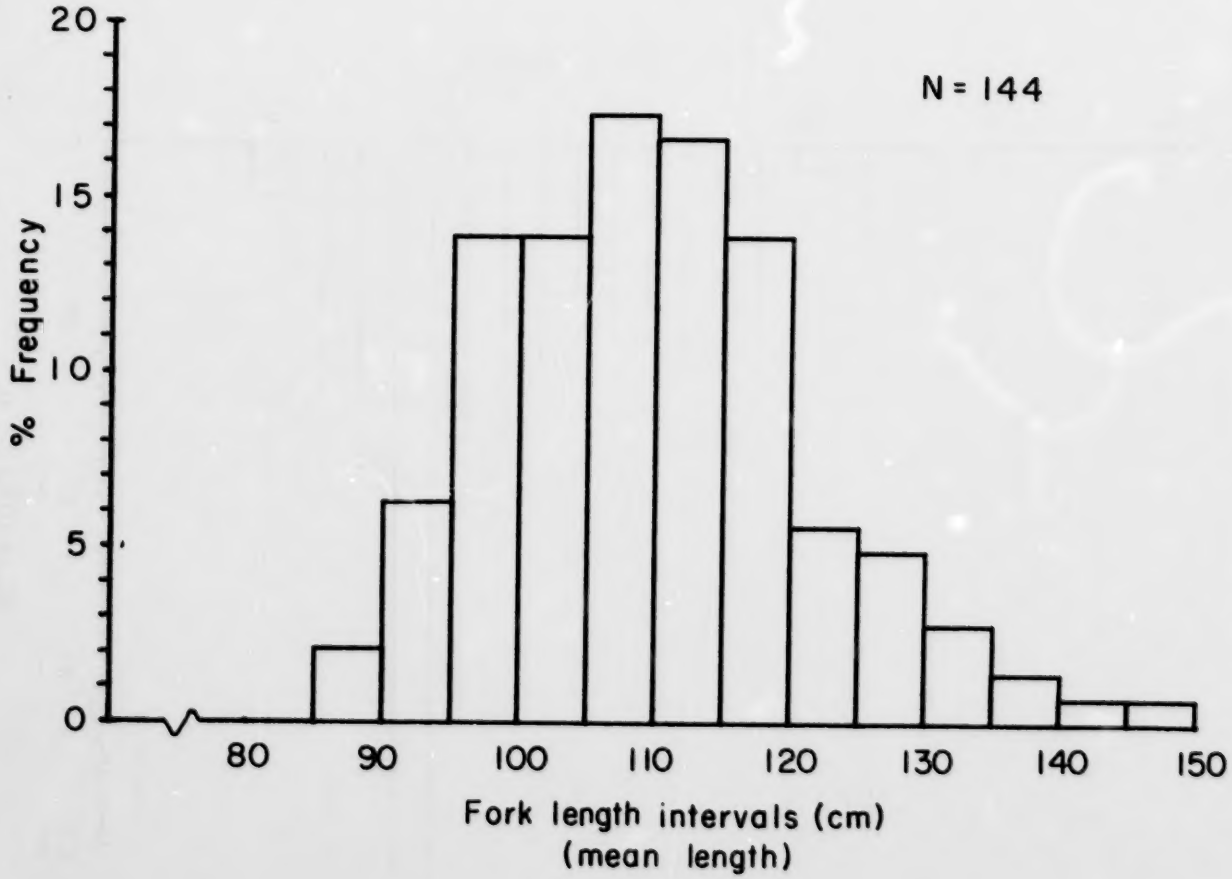

Fig. 5. Length frequency distribution of sturgeons taken in 1978. Mesh sizes used were 10-12 inches.

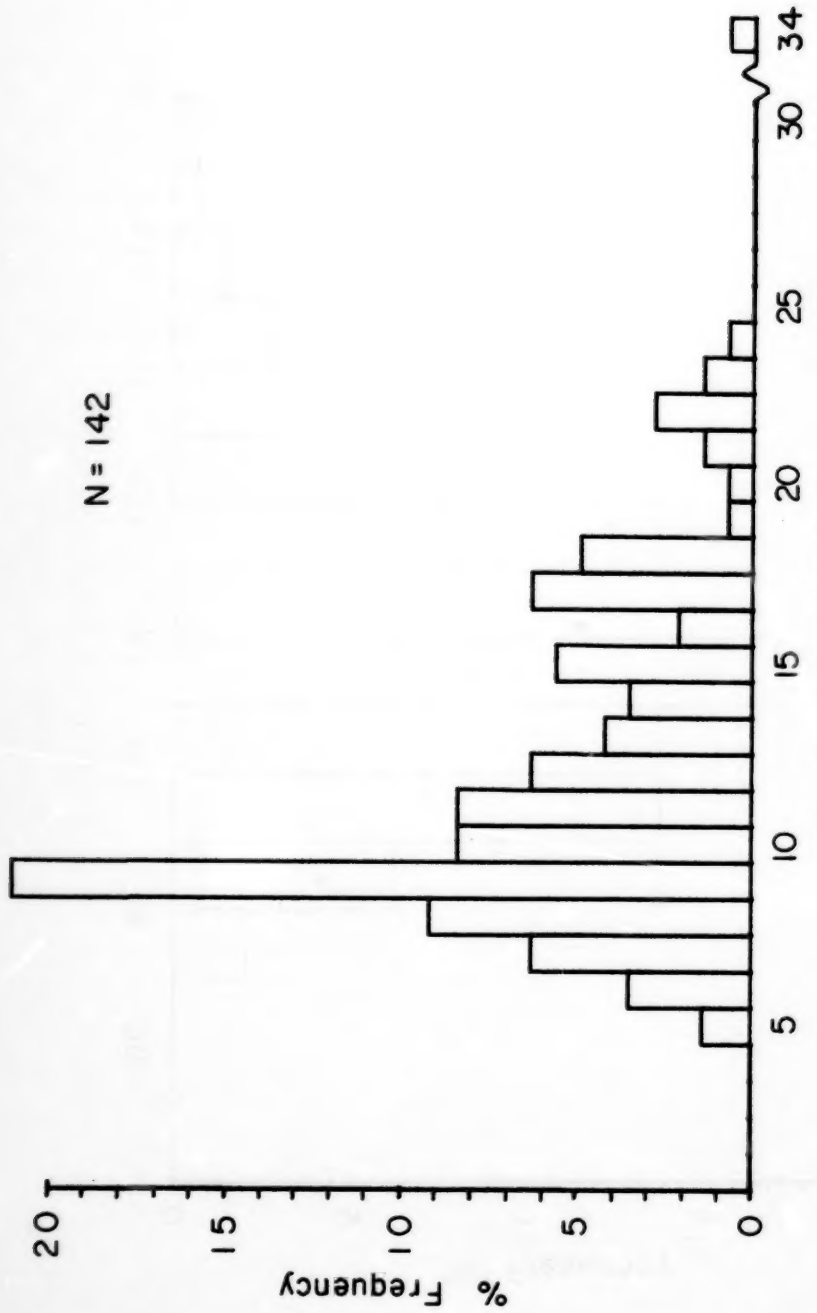

Fig. 6. Weight frequency distribution of sturgeons taken in 1977.

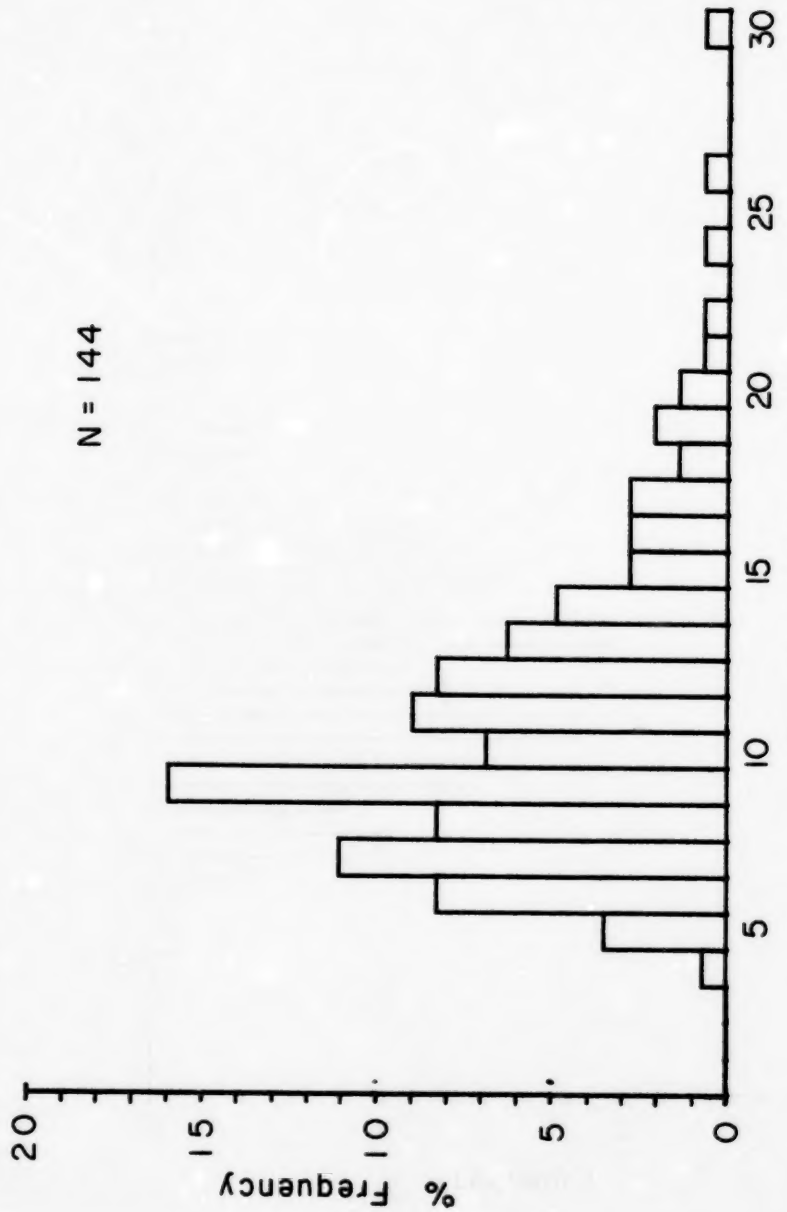

Fig. 7. Weight frequency distribution of sturgeons taken in 1978.

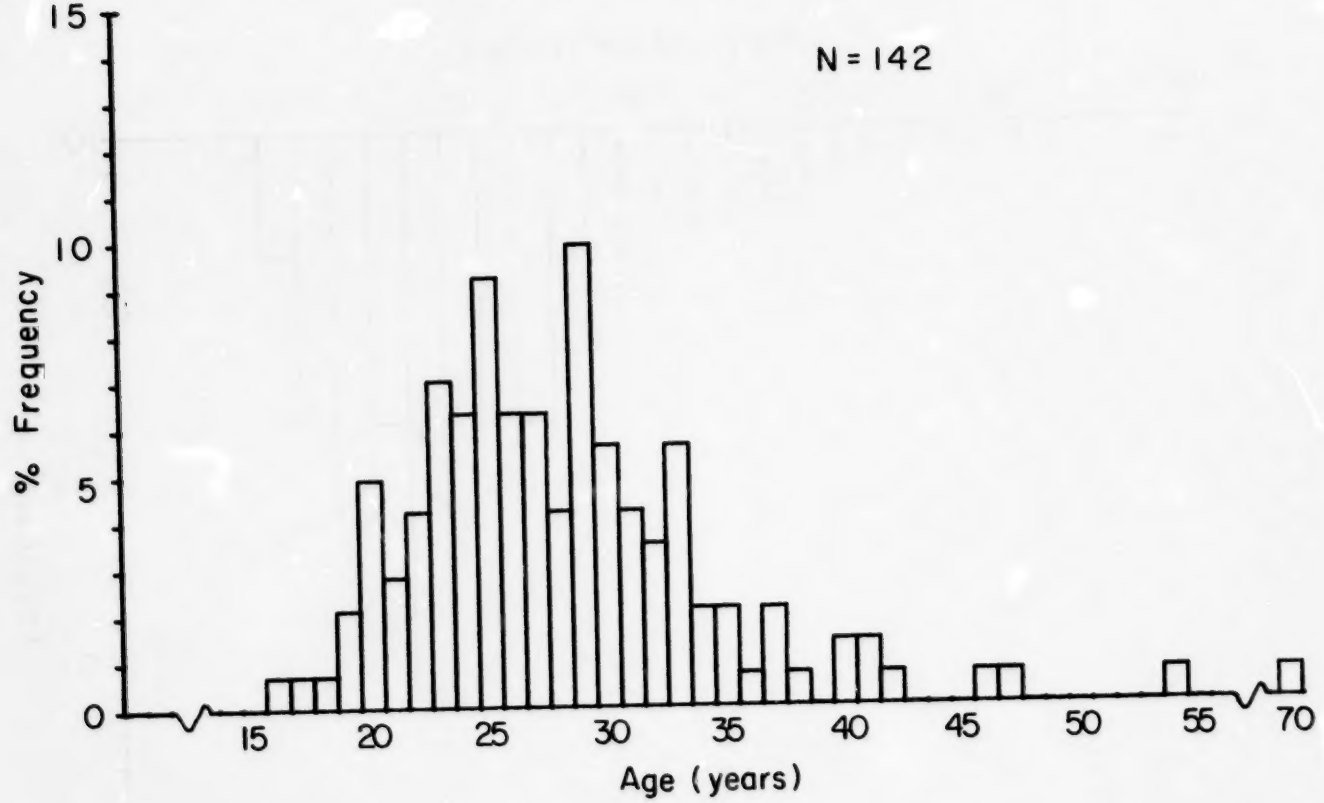

Fig. 8. Age frequency distribution of sturgeons taken in 1977. Mesh sizes used were 10-13 inches.

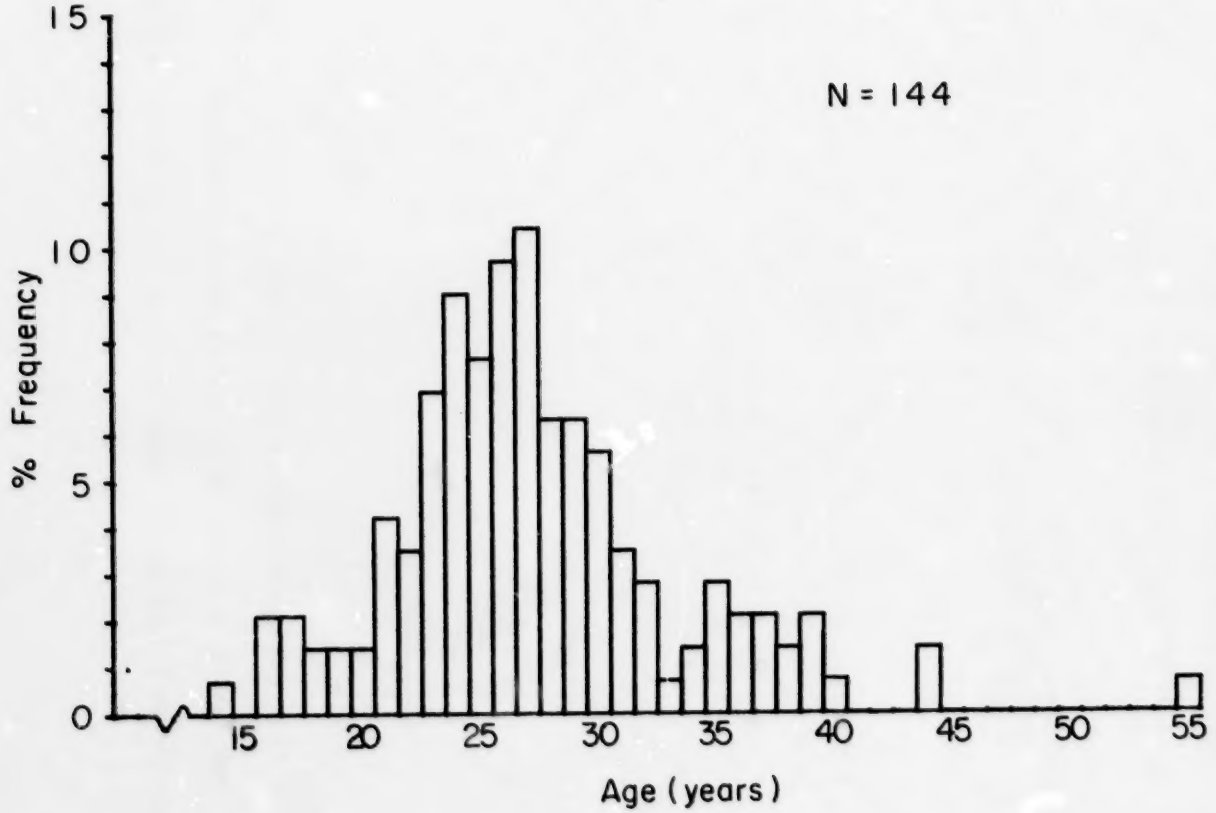

Fig. 9. Age frequency distribution of sturgeons taken in 1978. Mesh sizes used were 10-12 inches.

would be of the numbers of sturgeons in the vicinity of the Landing River during the 1978 spawning season.

The adjusted Petersen estimate (Ricker, 1975) was used to estimate population size. The formula is:

$$\hat{N} = \frac{(M + 1)(C + 1)}{(R + 1)}$$

where:

M = number of fish marked

R = number of recaptures

C = number examined for marks, i.e. the number of fish taken by commercial fishing.

$\hat{N}$ = population estimate

The population estimate thus became:

$$\hat{N} = \frac{(M + 1)(C + 1)}{(R + 1)}$$

$$= \frac{145\ (347)}{16}$$

$$= 3236$$

Ricker (1975) recommends that confidence limits are best obtained from tables appropriate to the binomial or Poisson distribution with R (number of recaptures) as the entering variable.

Thus the 95% confidence limits for R become 8.4 and 24.8 (Appendix II, Ricker 1975). Substituting these limits for R into the adjusted Petersen estimate, the lower and upper 95% confidence limits for the population estimate are 1951 and 5353, respectively.

The exploitation rate of any fish population can be estimated by:

$u = R/M$ (Ricker, 1975)

Where:

R = number recaptures

M = number marked

u = exploitation rate or the percent of the population (by number) harvested.

During 1978:

$u = 15/144$

$= .104$

The variance estimate is (Ricker 1975):

$$S^2 = \frac{R(C - R)}{M^2C}$$

where the symbols have been defined previously.
Therefore:

$$S^2 = \frac{15(346 - 15)}{(144)^2 (346)}$$

$= .00069$

$S = .026$

And the 95% confidence limits for the exploitation rate becomes:

$$0.078 < u < 0.130$$

The exploitation rate calculated in this manner is necessarily a minimum, since the number of tags returned is a minimum due to possible incomplete tag reporting by fishermen.

Mortality and Survival

In order to bolster the number of fish in each age class, age frequencies were combined for 1977 and 1978 (Figure 10) in the estimate of mortality rate. Using age 26 as the first fully recruited age (Figure 10), the survival rate was determined as follows from Ricker (1975):

$$S = e^{-Z}$$

where:

S = total annual survival rate

-Z = slope of regression line of log percent in each age class vs age (= Total instantaneous mortality rate)

The other important relationship as modified slightly from Ricker (1975) is:

$$\frac{f}{Z} = \frac{u}{1-S}$$

where:

1-S = total annual mortality rate

u = exploitation rate

f = instantaneous fishing mortality rate

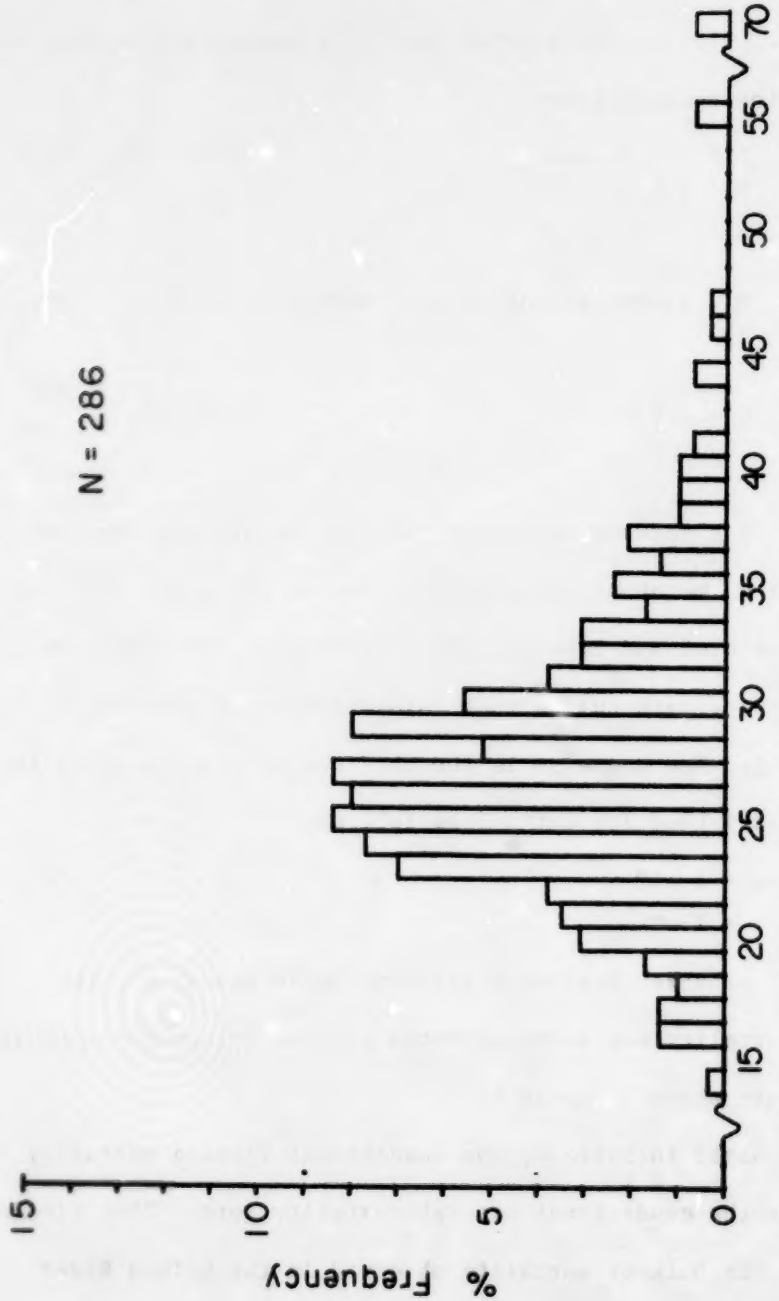

Fig. 10. Age frequency distribution of sturgeons for 1977 and 1978 combined. Mesh sizes used were 10-13 inches.

The relationship is true if natural and fishing mortality operate concurrently. Ricker (1975) notes that this assumption is most used in fish production computations:

$$Z = f + m, \text{ and}$$
$$m = Z - f$$

where:

m = instantaneous natural mortality rate.

Similarly

$$1 - S = u - V$$

where:

V = natural mortality rate in the presence of fishermen.

Using the above relationships we can calculate the conditional natural and fishing mortality rates. The conditional natural mortality rate (u) is that rate which would operate if there was no fishing. The converse is the conditional fishing mortality rate (m). These variables are defined as follows:

$$n = 1 - e^{-m}$$
$$m = 1 - e^{-f}$$

Ricker (1975) provides further details on these concepts. The calculated mortality and survival rates for the Nelson River sturgeon populations are shown in Table 4.

As noted in Table 4, the conditional fishing mortality rate is 17.4 times the conditional natural mortality rate. Thus fishing accounts for the bulk of mortality observed in the Nelson River sturgeon population around Landing River.

Table 4. Mortality, exploitation and survival rates for the Nelson River sturgeon population in 1978.

Instantaneous total mortality rate (Z)	0.1164
Instantaneous fishing mortality rate (f)*	0.1104
Instantaneous natural mortality rate (M)*	0.0060
Total annual survival rate (S)	0.8901
Total annual mortality rate (1-S)	0.1099
Fishing mortality or exploitation rate (u)	0.1042
Natural mortality rate (V)	0.0057
Conditional fishing mortality rate (m)	0.1045
Conditional natural mortality rate (n)	0.0060

* $\frac{f}{Z} = \frac{u}{1-S}$

$f = 0.1104$

$Z = f + M$

Therefore

$m = 0.1164 - 0.1104 = 0.0060.$

Sturgeon Migration

To date, a total of 47 tagged sturgeon have been recaptured (and recorded) from the Nelson River and Sipiwesk Lake (Appendix 2). The majority (56%) of these were recaptured within 30 days of release. Over half the recaptures (57%) were made in areas 2 to 4 (Figure 11) and within 10 km of the tagging site. Only 3 fish were ever recaptured downstream of the tagging site (Area 1), while 14 were recaptured upstream in Sipiwesk Lake (Areas 6-8). Since most of the commercial fishing effort is centered upstream of the Landing River near Sipiwesk Lake, the distribution of recaptures may be primarily a function of fishing effort.

Sex and Maturity

Since all sturgeons were tagged and released, sex could only be determined for ripe fish. Except for one female sampled in 1977 all of the ripe fish were males. Female sturgeons are in spawning condition for only a very brief period of time in the spring (Scott and Crossman, 1973), so it is conceivable that ripe females were missed during the course of the present study.

Only in 1977 were enough ripe males captured to allow tentative observations on age and length characteristics of males. The minimum age of a ripe male sturgeon was 20 years and the minimum size was 100 cm (fork length) and 9.0 kg (round weight).

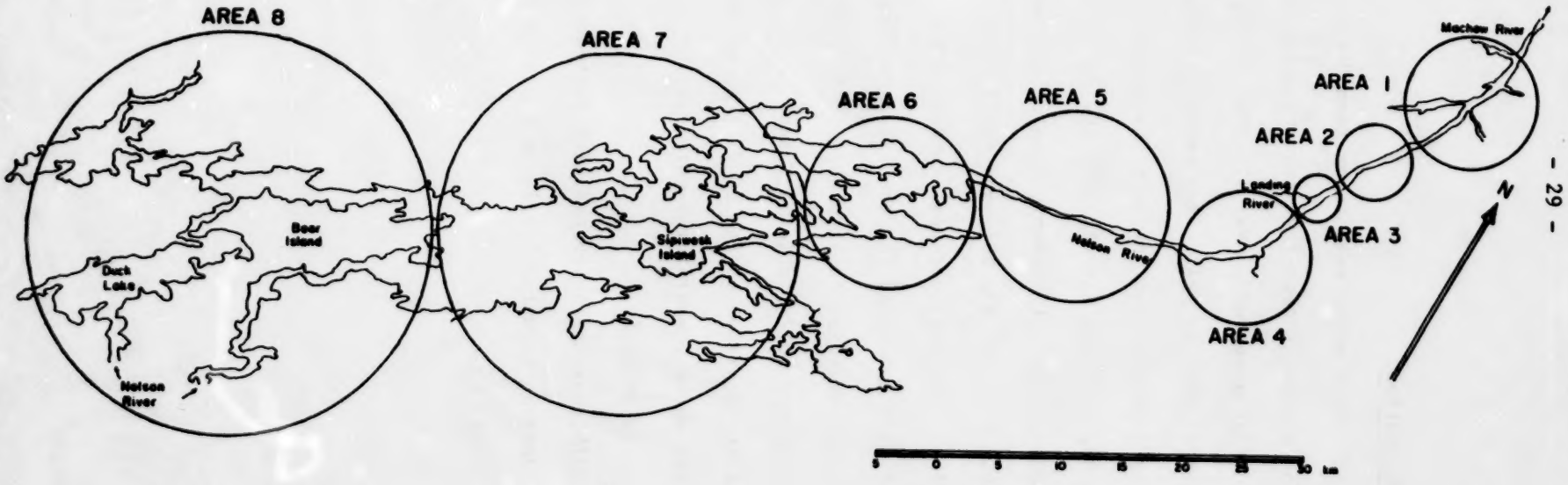

Fig. 11. Map of Sipiwesk Lake and Nelson River detailing areas in which tagged sturgeon were recaptured, 1976 to 1986.

The Spawning Migration

In 1977 ripe males were taken from May 12 to May 23, the duration of the study. Though few ripe sturgeons were taken in 1978, the first ripe fish appeared on May 31. The spring of 1978 was considerably later than in 1977. For example, conservation officer reports indicate that ice left the Nelson River below Sipiwesk Lake on April 30, 1977 and May 18, 1978 (K. deGraff, Conservation Officer, Wabowden, personal communication). Ice left the Saskatchewan River at The Pas on April 23, 1977 and May 3, 1978 (E. B. Johanson, Fisheries Officer, The Pas, personal communication). It seems that the late spring of 1978 accounted for the late spawning migration. The water temperatures measured in late May, 1978, were similar to those measured in early May 1977 (Table 5). Because of the ice conditions, it was impossible to arrive at the Landing River site in 1978 before May 25. Perhaps water temperatures were similar in early May in both years, but this is unlikely.

In 1978, catches increased with increasing water temperature (Table 5) and decreasing water levels as measured by a water level height gauge (Table 6).

Table 5. Water temperatures and sturgeon catches in the Landing/Nelson Rivers tagging project.

Date		1977 Nelson R. T° C	1977 Landing R. T° C	1977 No. Sturgeon	1978 Nelson R. T° C	1978 Landing R. T° C	1978 No. Sturgeon
May	12			18			
	13	8.9	14.4	13			
	14	6.7	16.7	13			
	15	6.7	17.8	1			
	16	-	-	5			
	17	7.8	7.8	0			
	18	8.9	10.0	0			
	19	8.9	10.0	20			
	20	10.6	10.0	13			
	21	10.0	12.2	13			
	22	11.1	12.2	32			
	23	11.7	11.7	14			
	24	12.8	12.8	-		(nets 4 + 5 only)	
	25	-	-	9			
	26				6.7	12.2	5
	27				6.7	12.2	8
	28				7.8	13.3	9
	29				8.9	13.3	10
	30				8.9	14.4	20
	31				9.4	13.9	31
June	1				10.0	14.4	46
	2						
	3						
	4						
	5						
	6						

Table 6. Sturgeon catches and water levels in the Landing River, 1978.

Date	Gauge Height (cm)	No. Sturgeon Sampled
May 26	43.0	5
27	44.0	8
28	38.0	9
29	31.0	10
30	28.5	20
31	29.0	31
June 1	32.0	46

DISCUSSION

Comparisons with Other Studies

Sunde (1961) presented the first comprehensive study of the Nelson River sturgeon population. Certain assumptions must be made in order to compare the present study to Sunde's data. These are:

1. Gear selectivity differences were not significant for both studies.

   Sunde (1961) utilized commercial catch data (12 inch mesh) while we captured sturgeon in survey nets (10 to 13 inch mesh). However, since both data sets span wide ranges of sturgeon sizes and lengths, the differences in gear selectivity may be minimal.

2. Seasonal differences are insignificant.

   Sunde's (1961) data were collected over a wider time period (June - October) in any year, while our data were taken from mid-May to early June. However, since sturgeon, particularly the older individuals, grow very slowly (Scott and Crossman, 1973), the intra-seasonal differences in size may not be significant.

3. Ageing techniques are identical.

   Both studies utilized the sturgeon ageing techniques as outlined by Cuerrier (1951). Some of Sunde's (1961) sturgeon fin rays were aged in 1978 and few differences were noted (Martin Erickson, Fisheries Branch, personal communication).

Sunde (1961) provided a weight-length relationship for both sexes since his data were from a commercial sample. Because our fish were tagged and released, the relationship was for both sexes combined. For comparative purposes, the relationship from sturgeons in the Lake Winnebago region of Wisconsin is also provided (Probst and Cooper, 1954) in Table 7. There was little difference in the weight-length relationships between the three studies (Table 7). Even though the Wisconsin data were taken from a spear fishery (Probst and Cooper, 1954) the relationship is close to that obtained from both sets of Nelson River gillnet samples. Gear selectivity may not be important for sturgeon fisheries and may be due to the very "stable" population structure of sturgeon; i.e. slow growth rate and older fish.

Age Frequency Distributions

Sunde (1961) documented a progressive shift in the age structure of Nelson River sturgeon toward the younger ages between 1953 and 1959. At present, assuming that the ageing techniques are valid, the ages are again (or still) skewed toward the younger fish (Figure 12). In fact, the age frequency curve approximates the curve presented by Sunde (1961) for 1959, the year that commercial fishing was halted. Sunde (1961) calculated the mean ages of Nelson River sturgeon in 1953, 1954, 1955, 1956, and 1959 to be 38.5, 40.7, 35.8, 33.8, and 30.6 years old, respectively. These ages are considerably older than the mean age

Table 7. A comparison of weight/length relationships of sturgeons reported in other studies to those determined in the present study.

Year	Location	Relationship	Source
1953-56, 1959	Nelson R.	males: log W = -9.017 + 3.002 log L (n=331)	Sunde (1961)
		females: log W = -9.754 + 3.204 log L (n=354)	Sunde (1961)
1952-54,	Wisconsin	all fish: log W = -10.59 + 3.303 log L (n=799)	Probst & Cooper
1977	Nelson R.	all fish: log W = -11.85 + 3.03 log L (n=142)	present study
1978	Nelson R.	all fish: log W = -12.93 + 3.26 log L (n=144)	present study

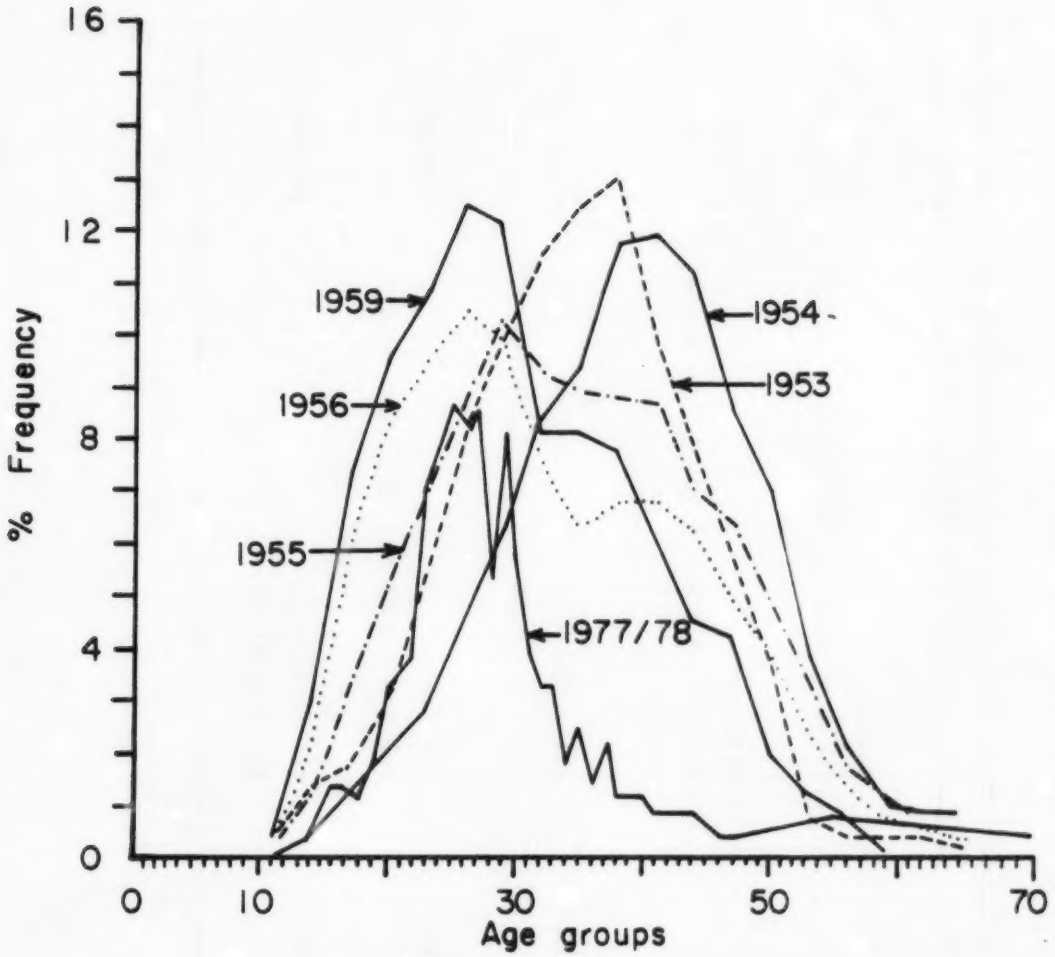

Fig. 12. Comparisons of age frequency distributions of Nelson River sturgeons observed by Sunde (1961) and that observed in the present investigation.

of fish in the present study.

The Effect of Exploitation

The preceeding analysis indicates that the Nelson River sturgeon population in the vicinity of Sipiwesk Lake is being subjected to high levels of exploitation relative to the mortality that would occur in the absence of fishing (see Table 4). The calculated total annual mortality rate, 0.1099, is low when compared with other fish species and would seem to indicate scope for increased exploitation. Healey (1975) classified whitefish populations as lightly exploited if total annual mortality was under 0.47, while some lake trout populations are able to withstand total mortality rates of up to 0.50. Lake trout are considered to be a slow-growing fish species that is less tolerant of exploitation than many other species. However, published mortality rates for lake trout (Healey, 1978) are far greater than for the Nelson River sturgeon.

The present study confirms the results of other studies that sturgeons are a very long-lived, slow growing species that, at least for older ages, is subject to very low mortality. Roussow (1957) concluded that sturgeons may spawn every 4 to 7 years and that spawning may be delayed 2 to 3 years after the onset of physiological maturity. The age of first reproduction and the frequency of breeding are important life history parameters that can greatly effect population size and the rate of population growth. Cole (1954) showed that for

any given "litter size" the intrinsic rate of population increase decreases with the age of first reproduction.

It seems that sturgeon have evolved a life history strategy which maximizes stability in that they are a long-lived, slow growing species whose populations are never large relative to other species. This implies that prior to commercial exploitation, sturgeon populations were well-buffered against environmental uncertainties. Other species populations may change significantly in response to environmental fluctuation such as the response of walleye (Stizostedion vitreum) to water temperature and flow (Forney, 1976; Derksen, 1967) and pike (Esox lucius) to spring water levels (Forney, 1968).

Commercial exploitation of sturgeon has probably increased the total annual mortality very significantly, although in many cases yields are not large in relation to other fisheries. The assertion that sturgeon populations are unable to withstand exploitation is supported by historical catch records; for example the 90% decline in the Lake Erie catch from 1885 to 1895. Sunde (1960; personal communication to S. Sigurdson, Director of Fisheries) noted that all of the commercial sturgeon fisheries in Northern Manitoba have eventually failed.

Sturgeon fishing has been carried out for a relatively short period of time (since 1970) on the Nelson River after the 11-year closure. It is difficult to project into the future, but considering the data from this and other studies it appears that proper management

of the Nelson River sturgeon population requires catch quotas that are enforced at low levels.

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APPENDIX I

Tag numbers, lengths, girths, weights and ages of lake sturgeons captured at the Landing River mouth in 1976, 1977 and 1978.

TABLE 1. Raw data from the 1976 Nelson River sturgeon study.

DATE	MESH (IN)	FISH NO.	LENGTH (CM) TOTAL	LENGTH (CM) DRESSED	LENGTH (CM) FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
June 3/76		S1 P824	110.8	73.7	114.3	47.0	15.9	
"		S3 P822	81.0	43.8	72.4	28.4	11.9	
June 4/76		S2 P823	111.1	68.6	103.5	41.9	10.5	
"		S5 P838	136.5	76.5	122.9	50.5	14.1	
"		S6 P839	113.7	69.5	109.5	45.1	19.1	
"		S7 P841	97.8	53.7	88.6	39.4	7.3	
"		S8 P842	114.6	65.1	105.1	35.6	8.1	
June 5/76		S10 P843	129.2	74.0	104.1	46.0	15.0	
"		S53 P845	115.6	67.0	108.6	40.0	10.5	
June 6/76		S56 P846	126.7	73.7	117.2	42.6	12.3	
"		S57 P847	147.0	86.0	113.0	55.3	20.4	
"		S58 P848	95.3	54.6	88.6	35.6	5.7	
"		S59 P849	153.0	90.5	144.2	53.7	22.3	
"		S60 P850	124.1	70.8	113.3	41.0	10.0	
June 7/76		S55 P75	83.8	48.9	77.2	30.8	3.8	
"		S61 P72	126.1	74.6	114.0	46.0	13.6	
"		S62 P74	-	91.4	141.3	56.8	25.5	
"		S65 P71	115.6	66.0	104.1	41.9	10.0	
June 8/76		S68 P70	119.4	71.1	109.0	44.8	11.8	
"		S69 P69	126.7	74.9	114.9	41.6	10.5	
June 9/76		S70 P68	126.4	67.3	111.8	45.7	13.2	
"		S71 P67	106.7	60.3	97.5	38.1	7.1	
"		S72 P66	121.0	69.5	112.7	42.9	11.8	
June 10/76		S64 P325	118.1	66.7	104.8	40.6	10.5	
"		S66 P324	104.1	57.5	94.0	39.4	6.8	

TABLE 1. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR.)
June 10/76		S73 P323	121.3	67.6	110.8	41.3	10.0	
June 13/76		S74 P853	127.0	75.9	115.9	47.0	14.6	
"		S75 P853	82.2	47.6	75.6	31.8	3.8	
June 15/76		S26 P854	104.1	55.6	93.3	36.5	6.2	
June 16/76		S27 P855	143.5	82.2	132.4	59.4	19.6	

TABLE 2. Raw data from the 1977 Nelson River sturgeon study.

DATE	MESH (IN)	FISH NO.	LENGTH (CM.) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 12, 1977		S30 P858	122.0	71.0	109.0	43.0	9.98	25
"		S31 P859	147.5	86.5	136.0	53.5	18.82	33
"		S32 P860	142.0	89.0	137.0	66.0	23.59	47
"		S33 P861	134.5	81.5	122.0	53.5	14.97	41
"		S34 P862	117.0	68.5	106.5	43.0	8.16	27
"		S35 P863	150.0	90.0	142.0	61.0	22.68	33
"		S36 P864	151.0	90.0	139.5	66.0	24.04	33
"		S37 P865	142.0	82.5	129.5	56.0	15.88	31
"		S39 P866	132.0	82.5	125.5	53.3	17.46	28
"		S40 P867	128.5	82.5	122.0	65.0	18.82	37
"		S41 P868	133.5	84.0	125.5	48.5	15.42	32
"		S42 P869	125.5	94.0	119.5	48.5	13.61	34
"		S43 P870	106.5	63.5	100.5	38.1	8.17	23
"		S44 P871	123.0	67.5	114.5	45.5	11.79	30
"		S45 P872	150.0	112.0	137.0	57.0	22.68	42
"		S46 P873	134.5	99.0	125.5	52.1	17.69	40
"		S47 P874	131.0	82.5	122.0	49.5	14.97	31
"		S48 P875	121.9	78.7	119.4	48.3	11.34	34
May 13, 1977		S49 P876	124.5	78.7	116.8	52.1	14.52	31
"		S50 P877	125.7	74.9	116.8	45.7	12.70	33
"		S52 P878	101.6	61.0	94.0	36.8	6.80	20
"		S54 P879	143.5	90.2	134.6	53.3	18.60	33
"		S67 P880	116.8	69.9	109.2	45.7	9.98	19
"		S76 P881	135.9	81.3	125.7	53.3	16.78	33
"		S78 P882	121.9	76.2	118.1	50.8	15.88	31

TABLE 2. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM.) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 13, 1977		S79 P883 (4)	127.0	73.7	118.8	45.7	12.70	29
"		S81 P885	121.9	73.7	115.6	48.3	15.88	29
"		S82 P886	143.5	85.1	132.1	58.4	22.68	37
"		S83 P887	141.0	81.3	130.8	50.8	17.69	27
"		S84 P888	128.3	72.4	118.1	43.2	11.79	25
"		S85 P889	116.8	67.3	108.0	44.5	9.07	22
May 14, 1977		S86 P890	116.8	71.1	111.8	43.2	10.89	25
"		S87 P891	133.4	78.7	124.5	49.5	15.88	32
"		S88 P892	106.7	63.5	100.3	36.8	7.71	28
"		S89 P893	127.0	74.9	116.8	49.5	13.61	27
"		S90 P894	114.3	78.7	105.4	44.5	9.3	26
"		S91 P895	124.5	71.1	113.0	41.9	10.89	27
"		S92 P896	125.7	73.7	116.8	50.8	13.61	29
"		S94 P897	128.3	78.7	120.7	52.1	15.88	28
"		S95 P898	135.9	78.7	124.5	49.5	15.88	29
"		S96 P899	121.9	73.7	115.6	45.7	11.34	25
"		S97 P900	147.3	86.4	137.2	61.0	23.59	38
"		S98 P901	116.8	68.6	106.7	40.6	9.53	25
"		S99 P902	157.5	94.0	148.6	68.6	34.02	70
May 15, 1977		S100 P903	144.8	82.6	130.8	53.3	17.69	30
May 16, 1977		S101 P904	113.0	66.0	106.7	40.6	9.07	25
"		S102 P905	124.5	71.1	114.3	45.7	12.93	26
"		S103 P906	114.3	81.3	104.1	38.1	9.07	23
"		S104 P907	142.2	83.8	129.5	54.6	18.6	37
"		S105 P908	101.6	55.9	95.3	39.4	6.35	20

TABLE 2. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM.) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 19, 1977		S106 P909	116.8	91.4	106.7	40.6	9.53	26
"		S107 P910	129.5	76.2	119.4	49.5	15.42	27
"		S108 P911	115.6	71.1	109.2	48.3	12.25	25
"		S109 P912	97.8	59.7	91.4	38.1	6.35	18
"		S110 P913	109.2	66.0	101.6	38.1	8.16	21
"		S111 P914	114.3	67.3	106.7	40.6	9.07	20
"		S112 P915	102.9	55.9	94.0	39.4	7.26	21
"		S113 P916	120.7	68.6	110.5	45.7	10.89	20
"		S114 P917	157.5	121.9	141.0	55.9	21.77	55
"		S115 P918	139.7	80.0	125.7	55.9	18.14	28
"		S116 P919	130.8	73.7	118.1	49.5	13.61	29
"		S117 P920	129.5	76.2	120.7	44.5	11.79	35
"		S118 P921	147.3	88.9	139.7	58.4	22.68	33
"		S119 P922	125.7	73.7	116.8	43.2	11.11	25
"		S120 P923	124.5	73.7	116.8	48.3	11.79	32
"		S121 P924	124.5	73.7	115.6	45.7	10.43	30
"		S122 P925	110.5	63.5	102.9	43.2	9.53	23
"		S123 P926	118.1	68.6	109.2	47.0	10.43	31
"		S124 P927	114.3	67.3	109.2	40.6	9.07	22
"		S125 P928	118.1	68.6	109.2	44.5	9.53	20
May 20, 1977		S126 P929	97.8	58.4	94.0	36.8	6.80	19
"		S127 P930	109.2	58.4	97.8	39.4	8.16	20
"		S128 P931	139.7	82.6	129.5	50.8	18.60	41
"		S129 P932	120.7	67.3	109.2	40.6	9.75	29
"		S130 P933	121.9	67.3	109.2	44.5	10.89	24

TABLE 2. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM.) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 20, 1977		S131 P934	121.9	70.0	114.3	48.3	14.52	25
"		S132 P935	109.2	61.0	101.6	41.9	9.07	24
"		S133 P936	139.7	82.6	128.3	54.6	19.50	35
"		S134 P937	116.8	66.0	106.7	41.9	9.98	26
"		S135 P938	100.3	55.9	91.4	40.6	7.71	24
"		S136 P939	130.8	77.5	121.9	61.0	17.69	29
"		S137 P940	142.2	82.6	130.8	49.5	17.46	40
"		S138 P941	116.8	66.0	109.2	43.2	9.98	23
May 21, 1977		S139 P942	137.2	78.7	127.0	53.3	18.14	30
"		S140 P943	99.1	55.9	88.9	38.1	7.71	-
"		S141 P944	124.5	67.3	116.8	43.2	11.34	35
"		S142 P945	127.0	78.7	124.5	50.8	13.61	36
"		S143 P946	113.0	63.5	104.1	40.6	9.07	24
"		S144 P947	116.8	66.0	106.7	40.6	8.85	23
"		S145 P948	127.0	73.7	118.1	41.9	10.66	30
"		S146 P949	110.5	41.9	102.9	43.2	8.62	25
"		S147 P950	129.5	81.3	125.7	49.5	17.24	30
"		S148 P951	134.6	82.6	129.5	53.3	21.09	29
"		S149 P952	117.5	67.3	106.7	45.7	12.25	27
"		S150 P953	118.1	67.3	108.0	40.6	9.07	24
"		S151 P954	104.1	62.2	96.5	40.6	8.17	26
May 22, 1977		S152 P955	105.4	63.5	102.9	41.9	9.53	26
"		S153 P956	109.2	64.8	101.5	43.2	9.53	24
"		S154 P957	129.5	77.5	121.9	47.0	11.34	29
"		S155 P958	123.2	71.1	114.3	45.7	10.89	22

TABLE 2. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM.) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR.)
May 22, 1977		S156 P959	144.8	85.1	134.6	58.4	20.41	46
"		S157 P960	96.5	53.3	86.4	35.6	5.89	16
"		S158 P961	111.8	64.8	102.9	43.2	8.62	24
"		S159 P962	104.1	58.4	94.0	33.0	5.90	17
"		S160 P963	111.8	63.5	101.6	40.6	9.07	27
"		S161 P964	139.7	83.8	129.5	50.8	16.78	30
"		S162 P965	114.3	68.6	106.7	39.4	9.07	20
"		S164 P966	121.9	72.4	113.0	44.5	12.70	23
"		S165 P967	115.6	68.6	106.7	43.2	9.98	23
"		S166 P968	114.3	66.0	105.4	43.2	10.89	34
"		S167 P969	106.7	61.0	96.5	38.1	9.07	19
"		S168 P970	113.0	63.5	104.1	43.2	9.53	26
"		S169 P971	109.2	61.0	99.1	40.6	7.71	21
"		S170 P972	127.0	72.4	121.9	48.3	12.7	24
"		S171 P973	109.2	63.5	101.6	36.8	6.80	28
"		S172 P974	105.4	61.0	99.1	39.4	7.71	24
"		S173 P975	113.0	63.5	104.1	40.6	8.62	25
"		S174 P976	120.7	69.9	110.5	45.7	10.43	32
"		S175 P977	119.4	68.6	110.5	44.5	11.34	28
"		S176 P978	133.4	77.5	121.9	48.3	16.56	29
"		S177 P979	116.8	66.0	108.0	40.6	9.07	23
"		S178 P980	129.5	74.9	116.8	54.8	17.24	29
"		S179 P981	110.5	66.0	104.1	40.6	9.07	22
"		S180 P982	127.0	74.9	123.2	49.5	17.01	31
"		S181 P983	111.8	63.5	104.1	40.6	9.53	22

TABLE 2. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 22, 1977		S182 P984	109.2	63.5	101.6	41.9	9.30	26
"		S183 P985	127.0	78.7	119.4	48.3	14.97	33
"		S184 P986	106.7	61.0	96.5	36.8	7.26	23
May 23, 1977		S185 P987	116.8	68.6	109.2	44.5	10.89	29
"		S186 P988	108.0	58.4	96.5	41.9	8.17	29
"		S187 P989	111.8	64.8	101.6	40.6	7.71	29
"		S188 P990	108.0	62.2	99.1	41.9	8.62	26
"		S189 P991	115.6	64.8	106.7	43.2	8.85	30
"		S190 P992	120.7	71.1	113.0	49.5	12.70	27
"		S191 P993	109.2	64.8	102.9	40.6	8.39	23
"		S192 P994	127.0	72.4	116.8	45.7	12.25	21
"		S193 P995	115.6	66.0	106.7	44.5	10.89	22
"		S194 P996	127.0	71.1	116.8	47.0	11.34	25
"		S195 P997	123.2	69.9	113.0	47.0	11.79	32
"		S196 P999	119.4	67.3	109.2	47.0	9.98	27
"		S197 P998	113.0	64.8	104.1	40.6	7.71	25
"		S198 P1000	118.1	67.3	109.2	53.3	13.61	

TABLE 3. Raw data from the 1978 Nelson River sturgeon study.

DATE	MESH (IN.)	FISH NO.	LENGTH (CM) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 26/78	12	S 201 P1526	116.5	68.0	108.0	40.0	9.53	26
"	12	S 202 P1528	131.0	75.5	118.0	58.0	16.78	34
"	12	S 203 P1529	115.5	68.0	108.0	44.0	9.07	26
"	12	S 204 P1530	142.0	85.5	131.0	54.0	17.92	39
"	12	S 205 P1531	125.0	75.0	114.0	48.0	12.25	35
May 27/78	10	S 211 P1532	111.5	66.5	101.5	42.0	10.43	31
"	10	S 214 P1533	124.0	74.0	116.0	49.0	13.61	28
"	10	S 215 P1534	121.0	72.0	114.5	41.5	11.57	28
"	10	S 220 P1535	114.5	69.0	109.5	42.0	10.43	26
"	10	S 221 P1536	117.0	68.0	108.5	39.0	9.98	26
"	10	S 223 P1537	125.0	75.5	117.5	40.5	10.21	26
"	12	S 226 P1538	122.5	73.5	116.5	42.0	10.43	35
"	12	S 227 P1539	136.5	84.0	126.5	52.0	17.69	36
"	12	S 228 P1540	151.0	92.5	142.0	62.5	24.49	44
"	10	S 229 P1541	112.0	63.5	103.0	45.0	9.07	27
May 28/78	12	S 230 P1542	96.5	56.5	89.5	37.0	5.44	16
"	12	S 231 P1543	149.5	100.5	139.0	67.0	26.76	40
"	12	S 232 P1544	145.5	88.0	134.5	57.5	20.64	44
"	10	S 233 P1545	120.0	74.5	113.0	53.0	12.70	24
"	10	S 234 P1546	122.0	72.0	111.5	44.5	11.57	25
"	10	S 235 P1547	103.5	61.0	95.0	39.5	6.80	24
"	10	S 236 P1548	108.5	61.5	99.5	40.0	6.80	21
"	12	S 237 P1549	107.0	62.5	99.0	40.5	7.48	22
"	12	S 238 P1550	120.0	69.5	112.0	42.0	9.75	20
"	12	S 239 P1551	105.0	62.5	98.0	40.5	7.71	23

TABLE 3. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 28/78	12	S 240 P1552	99.5	59.0	93.5	39.5	6.80	26
"	10	S 241 P1553	126.0	76.5	119.5	43.5	12.02	26
"	10	S 242 P1554	103.0	58.0	96.0	37.5	7.26	23
May 29/78	12	S 243 P1555	130.0	77.0	120.5	53.0	15.88	34
"	12	S 244 P1556	139.5	84.5	129.5	55.0	19.05	37
"	12	S 245 P1557	119.5	70.5	110.5	43.5	9.98	30
"	12	S 246 P1558	110.0	65.0	102.5	39.0	7.71	22
"	12	S 247 P1559	117.0	71.5	110.0	46.5	11.79	27
"	12	S 248 P1560	136.0	86.5	129.0	56.0	18.82	35
"	12	S 249 P1561	98.5	54.5	88.0	36.0	5.22	17
"	12	S 250 P1562	98.0	59.0	92.5	33.0	4.99	22
"	10	S 251 P1563	130.0	78.0	118.5	48.5	13.61	29
"	12	S 252 P1564	148.0	89.5	137.5	58.5	22.91	37
"	12	S 253 P1565	130.0	76.0	118.0	47.0	14.06	30
"	12	S 254 P1566	125.5	74.0	117.0	50.0	14.52	29
"	12	S 255 P1567	100.0	57.5	91.0	38.0	6.80	16
"	10	S 256 P1568	102.0	61.0	96.5	40.0	6.80	28
"	10	S 257 P1570	132.0	80.5	124.0	51.0	16.10	30
"	10	S 258 P1572	103.5	60.5	94.5	40.0	7.48	27
"	12	S 259 P1573	123.0	74.0	116.5	50.5	14.52	27
May 30/78	12	S 260 P1574	136.0	82.5	127.5	50.5	15.88	36
"	12	S 261 P1575	123.0	72.5	113.5	49.5	13.61	27
"	12	S 262 P1576	106.0	66.0	100.0	40.5	6.58	21
"	10	S 263 P1577	115.5	66.0	104.5	39.0	8.39	24
"	10	S 264 P1578	115.0	69.0	106.0	42.5	9.07	25

TABLE 3. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR.)
May 30/78	10	S 265 P1579	117.0	70.0	108.0	42.5	9.75	25
"	10	S 266 P1580	112.0	67.0	105.0	39.5	9.98	26
"	10	S 267 P1581	134.0	80.5	124.0	54.5	18.60	32
"	10	S 268 P1582	123.0	72.5	112.0	52.0	13.61	30
"	10	S 269 P1583	107.0	65.5	100.0	44.0	9.30	18
"	10	S 270 P1585	120.5	72.0	112.5	44.5	11.34	28
"	10	S 271 P1586	113.0	70.0	106.5	39.5	8.39	17
"	10	S 272 P1587	130.5	81.0	120.5	51.5	16.56	17
"	10	S 273 P1588	125.5	78.0	115.5	52.0	15.42	29
"	10	S 274 P1589	134.0	79.0	122.0	53.0	17.46	23
"	10	S 275 P1590	133.0	82.5	123.0	51.5	17.46	39
"	10	S 276 P1591	127.5	77.5	119.0	43.5	12.25	28
"	10	S 277 P1592	129.0	75.0	118.5	47.0	12.70	32
"	10	S 278 P1593	120.0	73.0	109.5	45.5	11.57	27
"	10	S 279 P1594	115.5	69.5	108.0	43.0	9.98	31
"	10	S 280 P1595	116.5	70.0	109.0	44.0	9.98	24
"	10	S 281 P1596	109.0	63.0	100.5	39.5	7.94	24
"	10	S 283 P1597	115.5	69.0	107.5	44.0	9.98	27
"	10	S 284 P1598	122.0	74.5	112.5	50.0	13.61	31
"	10	S 285 P1599	102.5	64.0	101.5	43.0	8.62	24
May 31/78	10	S 286 P1600	96.5	54.0	89.5	37.5	5.44	16
"	10	S 287 P1601	105.0	63.0	97.0	36.0	6.35	14
"	10	S 288 P1602	117.0	69.0	110.0	43.0	9.53	25
"	10	S 289 P1603	128.0	85.5	118.0	48.0	14.52	29
"	10	S 290 P1604	97.0	58.5	90.5	35.0	5.44	27

TABLE 3. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM)			GIRTH (CM)	WEIGHT (KG)	AGE (YR)
			TOTAL	DRESSED	FORK			
May 31/78	10	S 291 P1605	106.0	62.0	97.0	37.0	6.80	21
"	10	S 292 P1606	115.0	67.0	108.0	42.5	9.53	26
"	10	S 293 P1607	121.5	71.0	113.0	47.0	12.25	25
"	10	S 294 P1608	102.5	60.5	96.5	41.5	7.71	28
"	10	S 295 P1609	110.5	65.0	101.0	40.0	8.39	19
"	12	S 296 P1610	144.5	88.0	132.0	58.5	20.87	38
"	12	S 297 P1611	129.0	79.5	121.5	45.0	14.06	31
"	12	S 298 P1612	130.5	75.5	119.5	33.5	15.20	30
"	12	S 299 P1613	126.5	73.5	113.0	23.0	10.43	26
"	12	S 300 P1614	107.0	64.0	97.5	17.0	7.71	26
"	12	S 301 P1615	104.5	62.0	97.0	16.0	7.26	25
"	10	S 302 P1617	153.5	97.0	145.0	67.0	30.39	55
"	10	S 303 P1618	108.0	66.0	100.0	17.5	7.94	25
"	10	S 304 P1619	120.0	72.5	112.0	26.5	12.02	23
"	10	S 305 P1620	113.5	69.0	105.5	20.5	9.30	25
"	10	S 306 P1621	110.0	65.0	102.0	36.0	6.58	25
"	10	S 307 P1622	114.0	68.0	105.5	43.0	10.21	27
"	10	S 308 P1623	103.5	61.0	95.5	37.5	6.80	21
"	10	S 309 P1624	123.0	74.0	115.5	49.5	13.61	39
"	10	S 310 P1625	105.5	65.0	98.0	40.0	7.94	21
"	10	S 311 P1626	117.0	69.5	108.0	41.0	9.07	23
"	10	S 312 P1627	111.5	66.5	103.5	42.5	9.98	24
"	12	S 313 P1628	124.5	73.5	115.0	43.5	11.57	26
"	12	S 314 P1629	139.5	87.5	130.0	57.0	21.55	38
"	12	S 315 P1630	130.5	76.0	119.0	53.0	16.10	36

TABLE 3. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
May 31/78	12	S 316 P1631	116.0	68.5	107.5	44.0	11.34	25
"	10	S 317 P1632	98.0	57.0	90.5	37.0	5.90	21
"	10	S 318 P1633	112.0	66.0	103.5	42.5	8.85	33
"	10	S 319 P1634	116.5	69.5	108.5	42.0	9.75	24
June 1/78	10	S 320 P1635	118.5	70.0	109.5	41.5	9.75	32
"	10	S 321 P1636	98.5	57.5	91.0	37.0	6.35	23
"	10	S 322 P1637	110.0	65.0	103.5	40.0	8.16	26
"	10	S 323 P1638	109.5	63.5	100.0	42.0	8.85	23
"	10	S 324 P1639	105.0	63.0	96.5	37.0	6.80	20
"	10	S 325 P1640	125.5	73.5	114.0	43.0	10.43	27
"	10	S 326 P1641	122.5	72.5	114.0	43.5	11.11	31
"	10	S 327 P1642	116.5	70.0	111.0	46.5	12.25	24
"	10	S 328 P1643	107.0	61.5	98.0	42.5	8.16	23
"	10	S 329 P1644	113.5	66.5	104.0	41.0	8.62	19
"	10	S 330 P1645	106.5	64.0	99.0	39.0	7.48	24
"	10	S 331 P1646	100.5	59.5	95.5	40.0	7.71	23
"	10	S 332 P1647	124.5	72.0	113.0	45.0	11.57	22
"	10	S 333 P1649	138.5	84.0	129.5	53.5	19.50	37
"	10	S 334 P1650	110.0	65.0	101.0	41.5	8.85	22
"	10	S 335 P1651	120.0	69.0	107.5	48.0	12.47	29
"	10	S 336 P1652	124.5	70.5	114.5	47.5	11.34	29
"	10	S 337 P1653	116.0	77.5	105.5	42.0	9.30	27
"	10	S 338 P1654	116.0	69.5	108.0	43.5	10.89	32
"	10	S 339 P1655	138.0	87.0	128.5	55.0	19.05	35
"	10	S 340 P1656	124.0	74.0	115.5	51.0	14.06	27

TABLE 3. - Cont'd.

DATE	MESH (IN)	FISH NO.	LENGTH (CM) TOTAL	DRESSED	FORK	GIRTH (CM)	WEIGHT (KG)	AGE (YR)
June 1/78	10	S 341 P1657	128.5	73.5	120.5	51.5	13.83	29
"	10	S 342 P1658	114.0	70.0	107.0	44.5	10.89	27
"	10	S 343 P1659	121.5	70.5	111.0	49.5	12.47	27
"	10	S 344 P1660	107.5	63.5	100.5	40.0	8.85	23
"	10	S 345 P1661	99.0	61.0	94.5	41.5	8.16	29
"	10	S 346 P1662	135.5	76.5	125.0	48.0	14.06	30
"	10	S 347 P1663	122.5	73.5	115.5	46.5	12.02	27
"	10	S 348 P1664	119.5	69.5	110.0	46.5	11.34	30
"	10	S 349 P1665	103.5	62.0	97.0	39.0	7.71	24
"	10	S 350 P1666	124.5	74.5	116.0	47.5	12.70	25
"	10	S 351 P1667	109.5	67.0	103.0	55.0	10.66	28
"	12	S 352 P1668	115.0	72.0	108.5	43.5	11.34	28
"	12	S 353 P1669	115.5	70.0	108.0	45.0	11.57	29
"	12	S 354 P1670	120.5	73.5	113.0	48.0	13.15	28
"	12	S 355 P1671	120.0	75.0	110.0	48.5	13.61	30
"	12	S 356 P1672	108.5	65.5	98.5	40.0	9.07	18
"	12	S 357 P1673	112.0	64.5	102.5	40.5	9.30	26
"	12	S 358 P1674	102.0	62.5	94.0	38.5	7.71	24
"	12	S 359 P1675	103.5	63.5	99.5	38.5	7.94	24

APPENDIX 2

Recapture information for lake sturgeon from the Nelson River and Sipiwesk Lake, 1976-1986.

Appendix 2. Recapture information for lake sturgeon from Nelson River and Sipiwesk Lake, 1976-1986.

Tagging Date	Recapture Date**	Area of Recapture*								Total
		1	2	3	4	5	6	7	8	
1976	1976		1			1				2
	1977									0
	1978			1	1	1				3
	Total		1	1	1	2				5
1977	1977			6			2			8
	1978				2[a]		4[a]			6
	1980			1						1
	1981							1		1
	1982	1[a]								1
	Unknown						1	1		2
	Total	1		7	2		7	2		19
1978	1978				11[a]	1[b]	2[a]		1	15
	1980			3						3
	1981	1						1		2
	1986	1								1
	Unknown			1				1		2
	Total	2		4	11	1	2	2	1	23
Overall Total		3	1	12	14	3	9	3	2	47

* see Fig. 11 for Area descriptions
** dates are May or June unless other stated
a one recaptured July
b recaptured September